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DEPARTMENT OF COMMERCE
BUREAU OF STANDARDS
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GENERAL NOTE.

Owing to the current nature of the investigations mentioned in the Technical News Bulletin, sometimes it will be impossible to supply printed information regarding them. However, in these cases, the Bureau will be pleased to furnish technical data to those engaged in the particular application of the subject, in order to avoid the delay incident to publication.

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1 Representative Committee of Gas Engineers

On a number of occasions, the Bureau of Standards has found it desirable to discuss with outside recognized authorities some of the gas engineering problems with which it has been confronted. Recently it has been deemed advisable to form a representative body of gas engineers whose advice could be obtained from time to time by the Bureau in connection with these problems. The first matter which will be brought before these representatives of the gas industry will be the consideration of the manuscript of Circular No. 32, "Standards for Gas Service", which has recently been revised by the Gas Engineering Section of this Bureau.

2 Revision of Circular No. 32 "Standards for Gas Service"

The Bureau of Standards Circular No. 32, which is the recognized authority in this country on matters of manufactured gas service, is being revised by the Gas Engineering Section. Since the last edition was published in 1915, the use of gas for cooking and in industrial appliances has greatly increased, while its use in open-flame burners has much diminished; also developments in the various gas-making processes, changes in the quality of gas-making materials available, and general economic conditions have introduced new factors which it is necessary to consider in such a publication. To meet these new conditions, it has

been necessary to entirely rewrite a considerable portion of this circular. In fact, this work would have been undertaken some time ago had not the war activities of the Bureau interfered.

The new edition will contain sections on the heating value of gas, its freedom from impurities, allowable gas pressure variations, gas meters and meter testing, general service requirements, enforcement of regulations regarding service, a form for service rules for use by regulating authorities, a discussion of present methods of manufacturing and distributing gas, as well as certain data which it is believed will be useful to those persons using this circular.

The revised manuscript of this circular has been completed by the Gas Engineering Section and will be brought up for consideration and discussion in the near future at a meeting of the Representative Committee of Gas Engineers. The suggestions and comments of the members of this committee will be given due consideration, after which this circular will be printed for distribution.

3 Accuracy of Electrical Measuring Instruments

An exhaustive paper on "The Accuracy of Commercial Electrical Measurements" requested by the Instruments and Measurements Committee of the American Institute of Electrical Engineers has been finished and submitted to the Chairman of the Committee. This paper is scheduled to be given at the convention in February, in the hope of arousing interest in the further standardization of electrical instruments.

The paper discusses the accuracy required in commercial electrical measurements, and the means of obtaining it, namely, proper choice, installation, use, and maintenance of instruments. Conditions of use, external disturbing influence, and features of design and construction affecting the accuracy for measuring voltage and current are mentioned. The sources of error in electrodynamic wattmeters are discussed, including the effect of instrument transformer errors. The principal factors affecting the accuracy of watthour meters are given. In conclusion, some improvements which should be soon forthcoming are mentioned.

4 Electron Tubes in Radio Telephone Transmitting Sets

One of the features of the work of the Radio Laboratory is a study of the use of electron tubes in radiotelephony, a discussion of which is given in a recent laboratory report. In this report are given the general principles of radio telephony, with particular attention to the operation of electron tubes in radio telephone transmitting sets.

For transmitting speech by radiotelephony, the intensity of the transmitted wave is changed in degree and at rates determined by the intensities and pitches of the sound produced by the speaker. A radio telephone transmitting set consists of a system to produce undamped radio-frequency waves, and a system for producing alteration or modulation of the intensity of these waves in accordance with the speech element. In this treatment, the electron tube is considered a variable resistor, of which the plate and filament are the terminals. The resistance is varied electrically by changing the voltage of the grid with respect to the filament. Analysis is made of the different types of circuits used in producing undamped waves, by the variable resistance method. It is shown that the output current of an electron tube generator system under certain conditions is roughly proportional to the voltage supply of the system. In radio telephone equipment, this supply voltage is varied by making this input voltage to the generator system the output voltage of a power speech amplifier. The grid voltage of the power amplifier is varied by the use of a transmitter microphone, battery, and transformer, in the same manner that the line voltage of a wire telephone system is varied.

5 Recent Radio Publications

Several scientific papers have recently been issued by the Bureau of Standards, describing the work which has been done in radiotelegraphy by members of the Radio Laboratory. One recent scientific paper also describes work done by a member of the Naval Aircraft Radio Laboratory located at this Bureau.

Airplane Antenna Constants - Scientific Paper No. 341, 15 pages. This paper describes methods used and the results obtained in connection with the study of the capacity, resistance, inductance, wave length, and transmitting and directional effect of various types of airplane antennas. This material was obtained by the aithor while an officer in the Signal Corps, United States Army, and is published with the consent of that organization.

Dependence of the Input Impedance of a Three-Electrode Vacuum Tube upon the Load in the Plate Circuit - Scientific Paper No. 351, 19 pages. This paper describes theoretical and experimental work in which it is shown that because of the capacities between the elements of a three-electrode vacuum tube, the input impedance of the tube depends upon the nature of the load in the plate circuit. The input impedance may even be characterized by a negative resistance when the load in the plate circuit is inductive. In such a case regeneration of oscillations can occur as a result of the coupling through the tube itself.

Variation and Direction of Propagation of Long Electromagnetic Waves - Scientific Paper No. 353, 15 pages. In this paper there is described a method of increasing the accuracy of direction finder settings for long waves. Observations of the variation of the direction of long waves with time are given, it having been found that rapid variations of as much as 90 degrees in the direction of the resultant wave front may occur in the case of very long continuous waves. These facts are related to the theory of propagation of such waves. The results given have an important bearing on the use of radio for beacon station or direction finding purposes.

Principles of Radio Transmission and Reception with Antenna and Coil Aerials - Scientific Paper No. 354, 61 pages. In this paper several formulas are worked out from fundamental electromagnetic theory by which the performance of any aerial can be calculated. The effectiveness of various types of antenna is discussed, and a formula for the radiation resistance of coil aerials is worked out. The fundamental principles of design of aerials are given, and reception factors are derived to which the received current or voltage are proportional. A number of problems for further research are suggested.

Determination of the Output Characteristics of Electron Tube Generators - Scientific Paper No. 355, 21 pages. In this paper a method of analysis of the operation of electron tube generators is given. It is explained how to design a circuit to obtain the maximum output with a given tube, or how to select a tube which will furnish, with reasonable efficiency, its maximum power to a particular output circuit.

Copies of any of these papers may be obtained by addressing the Director, Bureau of Standards.

6 Industrial Safety Standards

The conference on Industrial Safety Codes was held at the Bureau of Standards on December 8, to consider the methods to be followed in the development of a series of National Industrial Safety Codes, and their introduction into use. It is particularly desired to secure general cooperation in the preparation of these standards by those who will be concerned with their application and the work can be effective only when the efforts of all the interested parties are properly coordinated and a set of codes which can be applied uniformly in the different states is made available. At this conference, arrangements were made for a joint Safety Code Committee on which the Bureau will be represented, to recommend a list of codes which should have first attention as well as the most suitable organizations for carrying out their compilation. As a result of a vote, it is evident that the general sentiment is in favor of having the Bureau, as well as engineering societies and other bodies, prepare standards in accordance with the methods of procedure of the American Engineering Standards Committee, and submit the resulting codes for the approval of that committee, in order to secure their more general acceptance and use. The Bureau is now engaged in revising the National Electrical Safety Code which was published in 1916 and it is hoped to issue a new edition within a few months. A draft of a code for Head and Eye Protection was issued during the month and circulated for criticism. The work on this code is practically completed and it is hoped to print the first edition in the near future. The work of preparing a National Elevator Safety Code, in cooperation with the American Society of Mechanical Engineers, is nearly completed, and a final draft was prepared during December. It is now awaiting the approval of the committee which has had it in charge. The General Advisory Committee on Safety Codes, which was appointed by the Bureau to consider the question of policies and methods to be followed in safety code work, met on December 9. In view of the fact that the Joint Committee, which will be created as a result of the conference on December 8, will be concerned with this work, it was decided that the Bureau's committee need not make any recommendations at the present time, and it may be discontinued if the Joint Committee should become permanent.

7 Measurement of Thermal Expansion of Various Materials

Work in the determination of the thermal expansion of various substances has been quite active during the past month, 13 tests having been completed. The prospects are good for some interesting research work along this line during the next year, since the research material on hand for test is sufficient to keep the present laboratory force busy for 6 months. Seven proposed outlines have been drawn up covering the work of this section, and it is planned to give more of the time of this laboratory to research work than has been the case heretofore.

8 Work in the Testing of Track and Mine Scales

A great deal of work has been done by the Bureau's three sets of railroad track scale testing equipment. Car No. 1 operated during the past month in Tennessee, Pennsylvania, and the District of Columbia, testing three industry and one master scales. The work included a special investigation upon a new grain hopper scale at Altoona, Pa. Equipment No. 2 operated in the states of Washington, Oregon, Utah, and Colorado, testing 18 railroad-owned scales and 10 industry scales. Equipment No. 3 covered the states of Wisconsin and Illinois and made tests on 27 railroad-owned scales and 1 industry scale.

Owing to the unsettled conditions in the coal mining districts, due to the recent strike and also to unfavorable weather and bad roads, the Bureau's mine scale testing equipments were not in use during December.

9 Recent Weights and Measures Publications

The kitchen card, Miscellaneous Publication No. 39, previously mentioned in the Bulletin, has been revised and a second edition of 100,000 copies has been ordered. Large numbers of requests for this card are being received each day, and judging from the nature of the letters received, it has filled a long-felt want.

10 Strain Gage Test of 350-Ton Fitting Out Crane at the Philadelphia Navy Yard

The Bulletin has mentioned previously the contemplated test of the large fitting out crane at the Philadelphia Navy Yard. This crane has a capacity of 350 gross tons, and is probably the largest in the world. A field party of engineers from the Bureau conducted the work during December, and in spite of adverse weather conditions was able to take the necessary strain gage readings on all important members of this structure when under load. Owing to the peculiar difficulties which surrounded this work, the force engaged on it are to be commended for the satisfactory way in which they carried it through. It is believed that data of considerable interest have been obtained and the preparation of the report will be undertaken at once.

11 Service Tests of Concrete Floor Treatments

A number of surface treatments for concrete floors have now been under test for 18 months. Some of the surface coating materials which appeared to be in good condition at the end of one year of service are now wearing away in places where they have been subjected to the greatest use. The panels which were treated with the chemical hardeners, such as magnesium fluosilicate, sodium silicate, and zinc sulphate solutions still appear to be in very good condition. The panels treated with a solution of aluminum sulphate have now been in use for about 9 months and so far the results are very satisfactory.

12 The Effect of Cal on the Strength of Concrete

Tests to determine the effect of this substance on concrete have been mentioned in previous Bulletins. During the month of December, investigations were made to obtain information concerning the effect of Cal, in combination with materials containing amorphous silica, on Portland Cement mortars. No benefit appeared to be derived from the use of such mixtures over that obtained by the use of Cal alone. Mortars made from various natural cements were treated with Cal. The results varied considerably among the several brands, and, therefore, no general statement can be made as to the probable effect of Cal on this class of cement. The laboratory work in connection with this subject is practically completed and the results are being rapidly compiled for publication in the form of a report.

13 Consistency and Time of Set of Neat Cement Determined by New Method

A series of tests was made to compare a new method of making consistency and time of set determinations of neat cement with the methods now used in government specifications for Portland cement, as given in Bureau of Standards Circular No. 33. Both new methods involve the use of the flow table devised at the Bureau. The flow table test for consistency is based on the determination of the increase in diameter of a disk of neat cement, after it has been jolted a given number of times by a table arranged to be lifted and dropped through a definite height by means of a cam mounted on a suitable shaft. The new method for the time of set determination consists of making the test on disks of cement which have been made up for a given period of time. When the cement will no longer flow outward under the jolting action, it has reached its practical set. The tests made on several different consistencies of standard Portland cement, while limited, show that a cement of normal consistency by the Vicat needle (10 mm penetration) has a flow of 145% when 2 minutes old and when jolted 25 times through a drop of 1 cm on the flow table. The flow table test for consistency seems to be a more accurate, consistent, and logical determination than can be obtained by the Vicat needle method. Likewise, the results of the time of set tests by the flow table appear to indicate more nearly that point in the setting of the cement, beyond which it is no longer workable, than results obtained by other methods.

14 Slag as an Aggregate for Concrete

The results of the investigation made during the past two years on this subject have been summarized in a report called "Crushed Slag as Aggregate in Concrete". The products of three companies, the National Slag Company, the Birmingham Slag Company, and the New England Slag Company, were used in the investigation. The conclusions of the report are as follows: According to the tests reported, crushed slag as a coarse aggregate produced concrete of as high or higher strength than gravel. The tests have not been extensive enough to determine the durability of slag, but so far as they have gone, no signs of disintegration have been observed due to sulphide sulphur. Slag sand, because of its lack of fine material, does not produce easily workable concrete when used as fine aggregate. If it must be used, its working qualities can probably be improved by the addition of small amounts of fine sea sand, hydrated lime, or other similar material. In all probability, a larger amount of fine aggregate to replace some of the coarse aggregate would aid workability. Provisions

in specifications for slag aggregates calling for a maximum sulphide sulphur content of 1½% and a minimum weight per cubic foot of 70 pounds have been tentatively recommended.

15 Flat Slab Investigation

The preliminary work in connection with the elaborate investigation of a concrete and tile floor, mentioned in previous numbers of the Bulletin, has been carried forward rapidly. Beginning on November 26, a series of readings of deformation in steel and concrete were taken three times a day. A total of 18 gage lines were read each time. All these lines were distributed over the under side of the slab. These readings were continued until December 13, with the special purpose of obtaining certain information regarding concrete changes due to weather conditions, which were particularly variable. The material used for loading the floor slabs will consist of stack brick 5 x 8 x 4½ inches in size, the first application of load consisting of one layer of these bricks over all parts of the slab.

16 A Substitute for Jute Burlap for Sand Bags Used in Military Work

Preliminary laboratory tests have been completed in the investigation of substitutes for the jute burlap ordinarily used for sand bags by the Army. It has been shown that while paper does not equal burlap in tensile or bursting strength, it may, nevertheless, be made up into bags which will be of value for this purpose. Further tests are to be made on four types of paper, as well as on burlap and cotton fabrics and all these materials will be subjected to weathering tests to determine their deterioration under service conditions.

17 Deterioration in the Strength of Paper after Storage

As a result of tests upon approximately 150 samples of paper, stored since March, 1909, it is noticed that bonds and ledgers containing 100% rag did not deteriorate in bursting strength as much as printing, writing, and similar paper containing wood pulp. The loss in bursting strength for the first class of papers tested was about 11.9%, while the bursting strength for the second class was 20.4% less than when tested 10 years ago. While these conclusions have been derived from tests on about 150 samples, as noted above, a large number of additional samples will be tested soon and the results studied to determine, if possible, the cause and amount of the deterioration of paper in storage.

18 Manufacture of Automobile Crankshafts

At the request of a maker of 6-throw automobile crankshafts, the process of manufacture was studied with the idea of eliminating certain difficulties which had been encountered. It was found that much of the trouble was of a mechanical rather than metallurgical nature, although opportunities were found for various imporvements in this end of the process. A report, giving the Bureau's conclusions in the case, was issued for the benefit of the manufacturer interested,

19 Investigation of Electric Welding

A comparison of tensile tests on welded metal plates shows that the mechanical properties of the material produced at the Bureau are uniformly lower than those of the Wirt-Jones test, conducted by the Welding Research Sub-Committee. After carefully considering the situation, it would appear that the personal equation is an appreciable factor in welding. The testing of weld metal specimens produced at the Bureau will be held up pending the receipt of samples from certain commercial concerns. Microscopic examination and hardness tests do not show any well-defined relation between the physical properties and microstructure, evidently because of the premature failure due to the presence of flaws.

20 Investigation of Chilled Iron Car Wheels

For over half a century, the majority of the freight cars in use in the United States have been carried by chilled cast iron wheels. These wheels have given general satisfaction even under the greatly increased stresses due to the heavy rolling stock now in use. It has been noted for several years, however, that failures of freight car wheels occur quite frequently at the foot of long and steep grades. The cause of such failure appears to be the heating of the wheel produced by the prolonged application of the brakeshoes, this rise in temperature causing complicated stresses in the structure of the wheel. The stresses thus produced may be sufficient to cause cracking and failure and in all probability a derailment of the car under which the wheel is placed. In order to determine the exact temperatures in different portions of the wheel, after prolonged

heating of the rim, the Bureau has instituted a complete investigation of this subject. It is obvious that temperature measurements cannot readily be made upon a wheel in service and considerable ingenuity has been shown in perfecting a laboratory apparatus capable of producing conditions analogous to those met with on the road. The wheel is mounted in a vertical position and surrounded by electrical resistance coils insulated from but setting close against the rim of the wheel. Holes are drilled at all points at which it is desired to obtain temperature measurements and into these openings thermocouples are inserted. It is possible by regulating the flow of current through the resistor to raise the temperature of the rim to any desired amount, and the corresponding temperatures at other points may then be read. Quite a number of wheels have already been tested and others are being submitted from time to time by parties interested in the work.

Respectfully,

S. W. STRATTON

Director
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